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| APPLICATION NO.                | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
| 10/593,832                     | 11/21/2006  | Tadatoshi Kurozumi   | Q80768              | 5492             |
| 23373                          | 7590        | 01/04/2011           | EXAMINER            |                  |
| SUGHRUE MION, PLLC             |             |                      | NGUYEN, COLETTE B   |                  |
| 2100 PENNSYLVANIA AVENUE, N.W. |             |                      | ART UNIT            | PAPER NUMBER     |
| SUITE 800                      |             |                      | 1732                |                  |
| WASHINGTON, DC 20037           |             |                      |                     |                  |
| NOTIFICATION DATE              |             | DELIVERY MODE        |                     |                  |
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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|                              |                                      |  |
|------------------------------|--------------------------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/593,832 | <b>Applicant(s)</b><br>KUROZUMI ET AL. |
|                              | <b>Examiner</b><br>COLETTE NGUYEN    | <b>Art Unit</b><br>1732                |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 09 December 2010.
- 2a) This action is FINAL.      2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1-16 and 33 is/are pending in the application.
  - 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 1-16 and 33 is/are rejected.
- 7) Claim(s) \_\_\_\_\_ is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on \_\_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) All    b) Some \* c) None of:
    1. Certified copies of the priority documents have been received.
    2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- 1) Notice of References Cited (PTO-892)
- 2) Notice of Draftperson's Patent Drawing Review (PTO-947)
- 3) Information Disclosure Statement(s) (PTO/SB/08)  
 Paper No(s)/Mail Date \_\_\_\_\_
- 4) Interview Summary (PTO-413)  
 Paper No(s)/Mail Date \_\_\_\_\_
- 5) Notice of Informal Patent Application
- 6) Other: \_\_\_\_\_

## DETAILED ACTION

### ***Status of the application***

*Claims 1 and 33 are amended, claims 17 to 32 are cancelled.*

*Claims 1 to 16 and 33 are presented for examination*

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

### ***Claim Rejections - 35 USC § 103***

1. Claims 1- 16 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmori et al. (US2002/0150532) in view of Tanaka et al (US6544493) with further in view of Miyoshi (US6485701)
2. Regarding claim 1 and 33. Ohmori teaches a perovskite type composite oxide containing titanium oxide with formula M (TiO<sub>3</sub>) wherein M is at least one selected from Ca, Sr, Ba (alkaline earth metal) and Pb (Abstract, para 15). The production methods are not limited as long as the titanium oxide particles have brookite crystalline *at 10 to about 100% by wt.* (para 21, comparing to the claim of 20-100 mass % for claim 1 and at least 80 mass 5 for claim 33) using titanium tetrachloride as precursor. He further teaches that the brookite crystalline are formed by subjecting the anatase titanium oxide particles to thermal treatment in a vapor phase (para 22). As brookite crystalline is formed *in situ* from anatase crystalline under the thermal treatment in vapor phase

condition, it would be obvious that the content of *anatase* should be between 10-100 % by wt at the minimum despite that he does not specify that the content of anatase titanium oxide is 20 to 100 % by wt. The range is overlapped therefore it is obvious. (See MPEP. 2144). Tanaka et al (US6544493) on the other hand teaches titanium oxide particles process, also from titanium tetrachloride precursor, using vapor phase process in alkaline solution (Col 4, line 30, 105 aqueous sodium hexametaphosphate solution) wherein the particles have ultra-fine particulates excellent dispersibility and with little aggregation (Col 3, line 26-35). He further points out (in col 1, line 64 to col2, line 8) that the titanium oxide is generally produced either by hydrolyzing or by vapor phase process the titanium tetrachloride precursor and then reacted in the gas state with an oxidizing gas such as oxygen or steam at high temperature. However the liquid phase process (hydrolysis) undergoes heavy aggregation. Miyoshi (US6,485,701) further discloses a process to make small particle perovskite structure of oxide (barium titanate) with anatase crystalline exhibited ferroelectricity. The subject matter as a whole would have been obvious for one of ordinary skill in the art at the time of the invention to replace the hydrolysis process (causing heavy aggregation) in alkaline solution of Ohmori (para 30) with the teaching of Tanaka of vapor phase as both teach method of making titanium oxide compound using titanium tetrachloride as a precursor to produce titanium-containing mixed oxide particles having a small particle size with specific surface of 10- 200 m<sup>2</sup>/g with excellent dispersibility for a perovskite type product. As for the higher percent of anatase titatnium oxide claim, as said above Ohmori specifies clearly to obtain ultrafine particles, the titanium oxide has to have 10 to 100% by wt of

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brookite crystalline which is formed in situ by vapor phase from anatase crystalline

therefore the content of anatase crystalline would be from 10 to 100 % by wt. and

Miyoshi reconfirms by disclosing that small oxide with anatase crystalline having

perovskite structure would exhibit ferroelectricity.( Abstract, and Col 9, line 46-50)

Therefore it would have been obvious for one in the art at the time of the invention to

claim a high percentage of anatase of 20-100% by wt, in particular as high as 80% or

more when otherwise all the key elements have been known.

3. Regarding claim 2, Ohmori in view of Tanaka and Miyoshi disclose a method for producing a titanium-containing perovskite compound as claimed in claim 1, wherein primary particles of the titanium-containing perovskite compound have a diameter (D1) that is 50 to 200% the size of primary particles of the titanium oxide serving as a starting material, the size (D1) being determined by converting the specific surface area (S) of the particles obtained by the BET method to the total surface area of spheres in accordance with the following equation (i):

$$D1 = 6/\rho S \text{ (i)}$$

wherein  $\rho$  represents a density of the particles and S represents a BET specific surface area. Ohmori (para 0017-0019).

4. Regarding claim 3, Both Ohmori and Tanaka teach a BET specific surface area of 3-200 m<sup>2</sup>/g. Tanaka (col 3, line 26-35) and Ohmori (para 0015).

5. Regarding claim 4, Tanaka discloses the method for producing a titanium-containing perovskite compound as claimed in claim 1, using the titanium oxide

produced by oxidizing titanium tetrachloride at high temperature by using of an oxidizing gas at 500C or more. Tanaka (col4 line 6).

6. Regarding claim 5. Ohmori in view of Tanaka and Miyoshi disclose a method for producing a titanium-containing perovskite compound as claimed in claim 4, specifically, Tanaka teaches the titanium oxide produced by a vapor-phase method by respectively introducing a titanium tetrachloride-containing gas and an oxidizing gas which are heated in advance to 500°C or higher into a reaction tube at a flow rate of 10 m/sec or more. Tanaka (col4, line 1-23 ).

7. Regarding claim 6. . Ohmori in view of Tanaka disclose a method for producing a titanium-containing perovskite compound as claimed in claim 5, using the titanium oxide produced by retaining the titanium tetrachloride-containing gas and the oxidizing gas in the reaction tube for one second or shorter under a high-temperature condition higher than 600°C. Tanaka (col4 line 1-23).

8. Regarding claim 7. Tanaka discloses an average gas flow rate in the reaction tube of 10 m/sec or more which overlaps with the claim of 5 m/sec or more. Tanaka (col 4, line 10).

9. Regarding claim 8. Tanaka discloses a vapor-phase method by introducing the preheated titanium tetrachloride-containing gas and oxidizing gas into the reaction tube in such a manner that turbulence is generated in the reaction tube. Tanaka (col6, line41).

10. Regarding claim 9. Ohmori in view of Tanaka and Miyoshi disclose a method for producing a titanium-containing perovskite compound as claimed in claim 8, using the

titanium oxide produced by introducing the titanium tetrachloride-containing gas and the oxidizing gas into the reaction tube through a coaxial parallel flow nozzle and the inner tube of the coaxial parallel flow nozzle has an inside diameter of 50 nm or less (col6, line 48-60).

11. Regarding claim 10. Ohmori in view of Tanaka and Miyoshi disclose a method for producing a titanium-containing perovskite compound as claimed in claim 4-wherein the titanium-tetrachloride-containing gas has a titanium tetrachloride content of 10 to 100%. Tanaka (para 0018).

12. Regarding claim 11. Ohmori in view of Tanaka disclose a method for producing a titanium-containing perovskite compound as claimed in claim 5, wherein each of the titanium tetrachloride-containing gas and the oxidizing gas is heated in advance at 800°C or higher. Tanaka (para 0019).

13. Regarding claim 12. The method for producing a titanium-containing perovskite compound as claimed in claim 1, wherein the titanium oxide produced by a vapor-phase method has a mean particle diameter at a 90% cumulative weight on the particle size distribution curve (D90) of 2.2 µm or less. Tanaka (col 5, line 16).

14. Regarding claim 13. Ohmori in view of Tanaka and Miyoshi disclose a method for producing a titanium-containing perovskite compound as claimed in claim 1, wherein the titanium oxide produced through a vapor-phase method has a distribution constant n, as calculated from the following Rosin-Rammler equation (2), of 1.7 or more:

$$R=100 \exp(-bD^n) \quad (2)$$

Wherein D is a particle diameter; R is the percentage of the number of particles larger than D (particle diameter) with respect to the total number of particles; n is a distribution constant; and b is a reciprocal of particle characteristic constant. Tanaka (col4 line 50-col 5, line16).\\

16. Regarding claim 14. Ohmori in view of Tanaka disclose a method for producing a titanium-containing perovskite compound as claimed in claim 1, wherein the titanium oxide produced by a vapor-phase method contains anatase-crystal-form titanium oxide. Tanaka (para 0035, "The fine particulates of titanium oxide of the present invention may be contained as a pigment or a particle component using the photocatalytic effect in various compositions". Only anatase crystal form of titanium oxide exhibits this characteristic, not the brookite type.

17. Regarding claims 15 and 16. Ohmori in view of Tanaka and Miyoshi disclose a method for producing a titanium-containing perovskite compound as claimed in claim 1 using an alkaline solution in which a basic compound exits and wherein the basic compound is selected from ammonium, organic amine and hydroxide of ammonium salt. Ohmori (para 27, 28). Despite that "organic amine" is not specified, it would have been obvious for one of ordinary skill in the art to select organic amine as it is an organic alkali compound such as ammonium tetramethyl hydroxide as taught by Ohmori.

***Response to Arguments***

15. Applicant's arguments filed 10/25/10 have been fully considered with the following comments:
16. The examiner would like to thank you the applicant's representative to point out the typographic error in the Ohmori 's application number. The correct number is US2002/0150531.
17. Claims 1 to 16 and 33 are rejected as being unpatentable under 35 USC 103(a) as obvious with the teaching of Ohmori (US2002/0151531) in view of Tanaka (US6,544,493) and Miyoshi (US6,485,701) as all three teach the method of making perovskite titanium type composite oxide particles. Ohmori teaches M(TiO<sub>3</sub>) wherein M is at least one of Ca, Sr, Ba, Mg (alkaline earth metal compound) and Pb by subjecting the anatase titanium oxide particles to thermal treatment either in a vapor phase (para 22) or in a liquid phase with the particles specific surface area of 10 to 200 m<sup>2</sup>/g. The reaction conditions are not particularly limited, and it is preferable to carry out the reaction in an alkaline solution (para 30-33). He is silent about the ferroelectricity. Tanaka reinforces the vapor process by teaching a process to make ultrafine particulate titanium oxide with specific surface area of 5 to 200 m<sup>2</sup>/g wih excellent dispersibility by vapor process the precursor titanium tetrachloride same as Ohmori. He does not discuss perovskite and ferroelectricity. Miyoshi discloses a process for producing an oxide perovskite barium titanate having ferroelectricity by preparing a TiO<sub>2</sub> powder having a specific surface area of about 10 m<sup>2</sup>/g or more (most are anatase) with heat treat at a lower temperature at a partial pressure of oxygen of 2 x 10<sup>2</sup> Pa or less,

particularly the vaporizing step the resulting mixed powder. From these three disclosures, it would be obvious for one ordinary skill in the art at the time of the invention to combine the three teachings and produce a titanium containing perovskite compound exhibiting ferroelectricity by reacting titanium oxide (produced through a vapor phase method) with at least one element of the alkaline earth metal compound and Pb in an alkaline solution with titanium oxide as rutile and anatase at 20 to 100 mass %.

18. The argument of unexpected results is not convincing as there is no affidavit or declaration filed to prove otherwise. A statement of unexpected result from the attorney's remarks and argument is not sufficient.

19. Ohmori points out two methods of producing, vapor process and hydrolysis in liquid phase and anyone in the art at the time of the invention would be motivated to experiment with the vapor phase if the hydrolysis in liquid phase has deficiencies as stated. And Tanaka discusses the advantage of vapor phases therefore vapor phase would be obvious to be chosen and reinforced by the teaching of Miyoshi of ferroelectricity.

20. In conclusion, the method as claimed in claims 1 to 16 and 33 are rejected.

### ***Conclusion***

21. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. EP1148030, EP1231186.

22. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to COLETTE NGUYEN whose telephone number is (571)270-5831. The examiner can normally be reached on Monday-Thursday, 10:00-4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Curt Mayes can be reached on (571)-272-1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

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USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/COLETTE NGUYEN/  
Examiner, Art Unit 1793

December 29, 2010

/Melvin Curtis Mayes/  
Supervisory Patent Examiner, Art Unit 1732